METEONORM VERSION 8

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ABSTRACT: Version 8 of the global climate database Meteonorm has been published in August 2020. This paper shows the most important updates. All types of meteo and climate data has been updated: historic climate values include now the last years; current time series based on satellite are covering almost the whole world and future IPCC data are totally updated with anomalies of three RCP scenarios. The paper shows also a new flow chart enabling the overlook of the different data sources and the two main products: the typical years and the time series.

1 INTRODUCTION

Meteonorm (www.meteonorm.com) is a climate database, which delivers typical meteorological years and time series of current data for any site worldwide. It's based on a combination of ground data, re-analysis and satellite data. Typical years in minute and hourly resolution are based on stochastic generation. The first version was published in 1985 and the first software edition in 1995 (Version 2) (Remund et al., 1998). Version 8 was published in September 2020 (Fig. 1). It's widely used by PV planners and also included in many PV simulation tools.

2 WHAT's NEW

The development of Meteonorm is done in small steps (called updates) every few months and in bigger one (called upgrade) every 4-8 years.
Version 8 includes the following major news:

- New main climate period: 2000-2019 for all non-radiation parameters
- New main climate period for radiation: 1996-2015
- New satellite data: now based on an own, globally homogeneous satellite model (described and benchmarked in 5BV.3.24)
- Ground and satellite data are blended to get the optimal results (Fig. 2)
- Inclusion of more parameters and coverage for current data (like precipitation, wind speed, humidity)
- Satellite data for Asia and the Americas (based on GOES-E/W, IODC and Himawari satellites) (Fig 2)
- New IPCC scenarios (RCP 2.6, 4.5 und 8.5)
- Urban heat for 100 sites in Europe based on Horizon 2020 project climate-fit.city.
- The software was partly refactored and updated. Climate data are mostly stored as png files to achieve maximum compression rates.

3 DATA SOURCES

In Meteonorm data sources are optimally combined to get the best for typical years and timeseries. It contains the following main sources:

- IPCC scenarios: Source: CMIP5; average anomalies of 10 models for temperature, precipitation, global radiation (accessed via Copernicus data store: https://cds.climate.copernicus.eu/)
- GEBA: Global Energy Balance Archive of ETHZ: monthly global radiation data (https://geba.ethz.ch/)
- Geostat. Data: processed with own empirical Heliosat method (Cano et al., 1986). Time periods:
  - GOES 11/15: 2010-2016
  - GOES 16: 2019-2020
  - MSG: 2010-2020
  - IODC: 2018-2020
  - HIM: 2019-2020
- Validation: see 5BV.3.24
- Met stations: different sources, mostly based on synop met stations (at airports); includes access to MeteoSwiss Swissmetnet stations
- ERA5/T: access to ECMWF reanalysis data; delay of approx. One month (also accessed via Copernicuse data store: https://cds.climate.copernicus.eu/)

Fig. 1. shows the usage and blending of the sources.

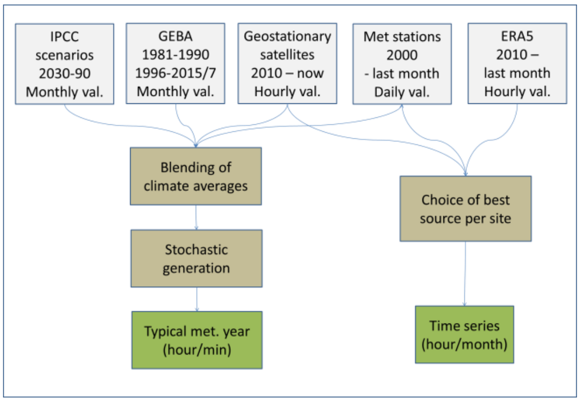

Figure 1: Data sources and pathways of data selection and generation: two main paths exist: one for typical met. years (TMY) and one for ongoing timeseries

4 RESULTS

The results of the updates are included in the version 8 published in September 2020. In upcoming months the data and methods will be also applied in the web service and dynamic linked library options.

Figure 2 shows the new GHI world map based on the combination of GEBA, BSRN and satellite data. Compared to earlier version 7.1 there are some differences visible (Figure 3).

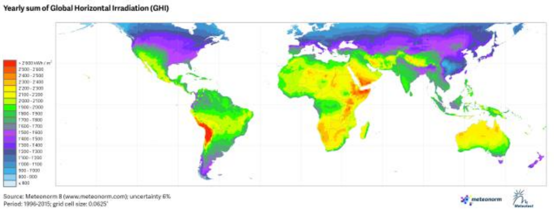

Figure 2: World GHI map of version 8.

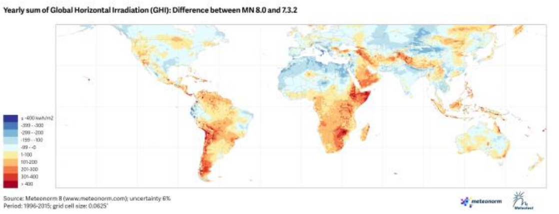

Figure 3: World GHI map differences between version 8 and 7.3.2.

The reason for the differences vary from region to region.

- Germany/Switzerland: sunnier climate
- Regions with high albedo: much better handling of high albedo areas (salt lakes, snow) compared to earlier versions
- Chile/Atacama: more realistic (higher) potentials
- Coasts: finer resolution
- Northern Africa: Heliomont database of MeteoSwiss – showing partially to high radiation values – has been removed
- Eastern Africa: unknown reason for higher levels. In this version not bound to ground sites any more

4.1 Uncertainties

The uncertainty of the satellite model is shown in paper 5BV.3.24.

Compared to Solar Atlas of World bank (https://globalsolaratlas.info/map) the differences are relatively small. MAE is in the range of 4%.

4.3 References

[1] Cano, D., Monget, J. M., Albuisson, M., Guillard, H., & Wald, L. (1986). A METHOD FOR THE DETERMINATION OF THE GLOBAL SOLAR RADIATION FROM METEOROLOGICAL SATELLITE DATA. *Solar Energy*, *37*(1), 31–39.

[2] Remund, J., Salvisberg, E., & Kunz, S. (1998). On the generation of hourly shortwave radiation data on tilted surfaces. Solar Energy, 62(5), 331–344.